Claims

1. A fuel injector in injection systems for internal combustion engines, which has a valve body (2) that contains a control chamber (19) whose pressure can be relieved, which control chamber can be acted on with fuel via an inlet throttle (32) and can be pressure-relieved via a first outlet throttle (17) whose closing element (43) can be actuated by an actuator (15), and the valve body (2) is connected to a holding body (5) that has a nozzle body (9) connected to it, which encompasses an injection valve element (11), characterized in that in order to relieve the pressure in the control chamber (19), an additional, second outlet throttle (18) is provided, whose closing element (49) can be actuated by an additional actuator (16) or as a function of the power supply (70, 73, 79) to a double-switching actuator (50).

2. The fuel injector according to claim 1, characterized in that the first outlet throttle (17) and the additional, second outlet throttle (18) are disposed opposite from each other inside the valve body (29).

3. The fuel injector according to claim 1, characterized in that the first and second outlet throttle (17, 18) are provided in inserts (30) disposed on opposite sides from each other inside the valve body (2).

4. The fuel injector according to claim 3, characterized in that the inserts (30) containing the first and second outlet throttles (17, 18) can be interchanged with others and are fastened in the valve body (2) by means of valve clamping screws (29).

5. The fuel injector according to claim 1, characterized in that the inlet throttle (32) is provided in an interchangeable insert piece (35), which is affixed in the valve body (2) by means of a high-pressure fitting (31).

6. The fuel injector according to claim 1, characterized in that the orientation of the inlet throttle (32) of the control chamber (19) is rotated by 90° in relation to the first and second outlet throttles (17, 18).

7. The fuel injector according to claim 5, characterized in that the inlet throttle (32) of the control chamber (19) in the valve body (2) is disposed opposite from a pressure measurement connection (34) that contains a throttle restriction.

8. The fuel injector according to claim 1, characterized in that the closing elements (43, 49) respectively associated with the outlet throttles (17, 18) are embodied as spherical.

9. The fuel injector according to claims 1 and 3, characterized in that the closing elements (43, 49) respectively associated with the outlet throttles (17, 18) are embodied as conical bodies that cooperate with a seat (48) embodied in the insert pieces (30).

10. The fuel injector according to claim 1, characterized in that the first and second actuator (15, 16) and the double-switching actuator (50) are embodied as solenoid valves.

11. The fuel injector according to claim 1, characterized in that the first and second actuator (15, 16) and the double-switching actuator (50) are embodied as piezoelectric actuators.

12. The fuel injector according to claim 1, characterized in that the holding body (5) is interchangeably fastened to the valve body (2).

13. The fuel injector according to claim 12, characterized in that the holding body (5) is fastened to the valve body (2) by means of a clamping nut (4).

14. The fuel injector according to claim 1, characterized in that the valve body (2) has a central high-pressure connection (3) that uses fuel to act on a nozzle chamber (12) encompassing the injection valve element (11) in the nozzle body (9), wherein the fuel in the nozzle chamber (12) flows in via an inlet bore (36, 57), which is embodied in the valve body (2) and in the holding body (5) and extends parallel to the central bore 6 in the holding body (5).

15. The fuel injector according to claim 1, characterized in that the double-switching actuator (50) is embodied as a solenoid valve whose magnet coil (50.1) triggers a first and second valve (60, 61), which are associated with the first and second outlet throttle (17, 18), in a slightly time-delayed fashion or one after the other, depending on the power supply to the magnet coil (50.1).

16. The fuel injector according to claim 15, characterized in that the power supply to the magnet coil (50.1) occurs with a first power supply curve (70) for the first valve (60) and with a second power supply curve (73) for the second valve (61) and the power supply curves (70, 73, 79) each include a current step-up (72, 75).

17. The fuel injector according to claim 15, characterized in that during the valve movement (77), only the first valve (60) opens, which is powered with a first power supply curve (70).

18. The fuel injector according to claim 16, characterized in that during a second valve movement (78), the first valve (60) and the second valve (61) are triggered with a second power supply curve (73) and open in a slightly time-delayed fashion.

19. The fuel injector according to claim 15, characterized in that the first valve (60) is triggered with a first power supply curve (70) during a first triggering period (77) and during a joint triggering period (80) of the first and second valves (61, 61), the second valve (61) can be powered with the third power supply curve (79).

20. The fuel injector according to one of claims 1 to 19, characterized in that it includes a pressure booster (86) with a piston (86.1) loaded by a spring (86.2) and that the low-pressure side of the pressure booster (86) is connected to a pressure reservoir (85) and the high-pressure side of the pressure booster (86) is connected to the nozzle chamber (12) of the fuel injector (1).

21. The fuel injector according to one of claims 1 to 20, characterized in that the piston area ratio between the high-pressure side and the low-pressure side of the pressure booster (86) lies in a range from 1:1.5 to 1:3.

22. The fuel injector according to one of claims 1 to 21, characterized in that the spring chamber (86.3) of the pressure booster (86) is connected via a discharge line (86.4) to the

connection of the second outlet throttle (18) oriented away from the control chamber (19) of the fuel injector (1).

23. The fuel injector according to one of claims 1 to 22, characterized in that the pressure booster (86) includes a check valve (87) that closes off the high-pressure side of the pressure booster (86) from the low-pressure side of the pressure booster (86).

24. A method for controlling a fuel injector according to one of claims 20 to 23, characterized in that supplying power to the first magnetic actuator (15) or a piezoelectric actuator causes the first outlet throttle (17) to open, thus relieving the pressure of the control chamber (19) of the fuel injector (1), and the resulting opening of the nozzle needle initiates the injection process.

25. A method for controlling a fuel injector according to one of claims 20 to 23, characterized in that supplying power to the second magnetic actuator (16) or a piezoelectric actuator causes the second outlet throttle (18) and also the discharge line (86.4) of the spring chamber (86.3) of the pressure booster (86) to open, wherein the resulting relief of the pressure in the control chamber (19) of the fuel injector (1) causes the nozzle needle to open and the movement of the piston (86.1) of the pressure booster (86) causes the nozzle chamber (12) of the fuel injector (1) to be acted on with a pressure that exceeds the pressure level in the pressure reservoir (85).

26. A method for controlling a fuel injector according to one of claims 20 to 23, characterized in that supplying power to both of the magnetic actuators (15, 16) or a

piezoelectric actuator causes both outlet throttles (17, 18) to open, wherein the resulting relief of the pressure in the control chamber (19) of the fuel injector (1) causes the nozzle needle to open and the movement of the piston (86.1) of the pressure booster (86) causes the nozzle chamber (12) of the fuel injector (1) to be acted on with a pressure that exceeds the pressure level in the pressure reservoir (85).